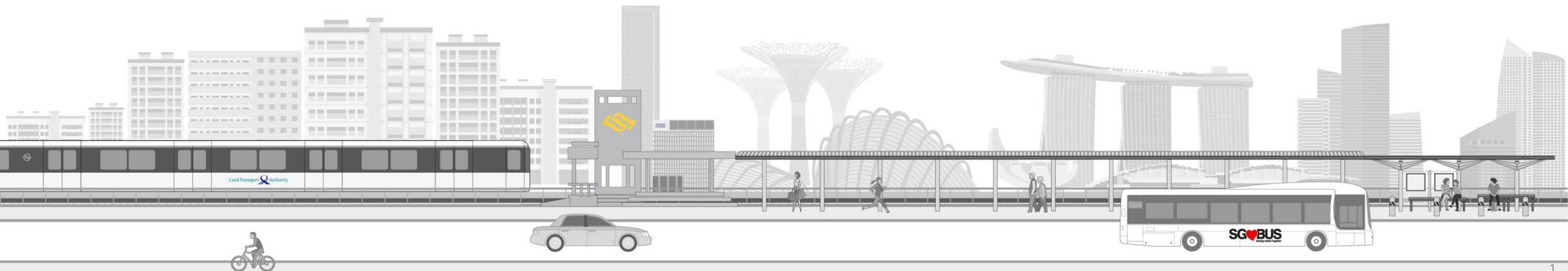


# Mobility Transformation in Singapore - with a Focus on Railway Policy

Er. Chua Chong Kheng

Deputy Chief Executive, Infrastructure & Development

Land Transport Authority of Singapore



# First Concept Plan

- Developed to guide Singapore's long-term development
- Proposed MRT as backbone of the public transport system

1970

## 1971 CONCEPT PLAN STRUCTURE



Image courtesy of Urban Redevelopment Authority

# The Great MRT Debate

- Due to large estimated cost for MRT construction, it faced opposition that an all-bus system would be sufficient and more cost-effective.

1970

1980



## 'A better life with rail-based MRT system'

THE construction industry has become overheated and if Singapore were to be foolish enough to want to build its proposed mass rapid transit (MRT) system now, it will find itself in trouble.

This warning was sounded by Dr Tony Tan last Friday at a forum on economic affairs at the NUS last Friday. The session was telecast by SBC last night.

But on a brighter note, the Trade and Industry Minister also said the construction labour shortage is easing and building costs appear to be stabilising, thus hinting that government may be able to step up its public housing programme soon.

Replying to questions, the minister also said: "Public housing is the most important construction project in Singapore. Government involvement in the economy is not necessarily bad (as witnessed by the housing programme which is the best in the world) but the principle of open competition should be retained.

High economic growth creates a better life because it leads to higher wages for workers. Rising affluence gives people the ability to go beyond dollars and cents and instead build a better quality of life.

Educational opportunities abound for bright students.

Foreign investors should not be compelled to enter into joint ventures with local firms.

No arrangements have been made to form a central bank.

### Housing

On public housing, Dr Tan said the construction industry is overheated and it will be necessary to phase in large projects, like the public housing programme.

"This is our most important construction project in Singapore," he said.

With the completion of Changi Airport (except for the second runway) which took a large part of Singapore's construction resources over the last five years, there will be additional construction capacity for other projects.

He said there are also signs the construction labour market has eased and that prices of materials have stabilised.

Replying to another question on Prof Milton Friedman's assertion that Singapore might have performed much better economically with less government involvement, Dr Tan asked if government had not been involved in the public housing programme, could anyone seriously believe that they could get better and cheaper flats?

He compared Singapore with Hongkong, pointing out that the average housing space for each Singaporean is three to four times that in the British colony.

Also, the average flat that a Singaporean can get (in the case of graduates after working a few years) is equivalent to two or three times the average flat which a "fortunate" resident in Hongkong can hope to aspire to get after he has worked for 10 or 15 years.

"We provide better housing for our people than any other government in the world. And we do it more cheaply, more efficiently."

But there is no substitute for the open competitive, free enterprise system. Compare those nations which follow the communist system with those following the free enterprise system, he said.

On inflation, Dr Tan said the last few years have been "rather difficult years" for both Singaporeans and others because of "very high and pervasive inflation."

"Higher bus fares and so on are all aspects of the same trend. But with higher economic growth comes one thing — higher wage levels. People earn more."

"Since 1979, for example. With the NWC increases, our national income level has grown by at least 10 per cent every year, higher than the rate of inflation, even in 1980 and in 1981."

### Satisfied

"In most of the developed countries in the world today, people would be quite satisfied if they could maintain their standard of living at the same level."

Dr Tan said that as Singaporeans become more affluent, "the main danger that will confront us is that we forget how we come to this situation."

"I think our aim must be that as our economic affluence rises, that we try and develop our society so that it becomes something more than caring about dollars and cents."

The minister said there is no bright child today who because of financial circumstances cannot go on to universities.

"In fact, when I was Vice-Chancellor of this university, we found that we had a peculiar problem on our hands. We have so many scholarships we couldn't find students to give the scholarships to."

There is no difficulty getting jobs. The ratio of jobs offered to those registered on the employment exchange is more than 2:1. "For every undergraduate who graduates from this university, you have no difficulty in finding a job. For every two school children who live in Britain today, only one will be able to find work, the other would have to wait for many years."

"There are many rights in the world today. The right to work is fundamental. It is something which we have given to our people. It is something which I hope would never be taken away from them."

**DR TONY TAN**

## MORE EMPHASIS ON HDB FLATS?

# Foolish to build MRT now: Tony Tan

By WONG MAI YUN

THE construction industry has become overheated and if Singapore were to be foolish enough to want to build its proposed mass rapid transit (MRT) system now, it will find itself in trouble.

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**DR TONY TAN**

## ITF issue proves most popular

# The Great MRT Debate

- The reclamation of Marina South tilted the debate in favour of building the MRT.

*The only way you can get to Marina South is through a road by the side of Telok Ayer Basin. If you have MRT going to Marina South, then that open space can be developed.*

*Mr Ong Teng Cheong, Minister for Communications*

1970

1980



# MRT Construction

- The government gave the go-ahead for MRT construction in 1982.
- First section of **North-South Line** was completed on 7 November 1987.



1970

1980

# First Two MRT Lines

- The **North-South** and **East-West Lines** were completed on 6 July 1990, within the approved budget of S\$5 billion.



Image courtesy of SMRT Corporation Ltd



# Establishment of Land Transport Authority

- The Land Transport Authority was established on 1 September 1995 to adopt a holistic approach to emerging land transport challenges.



**Increase in  
Transport Demand**



**Increase in  
Car Population**



**Rising Expectations for  
Quality Transport**

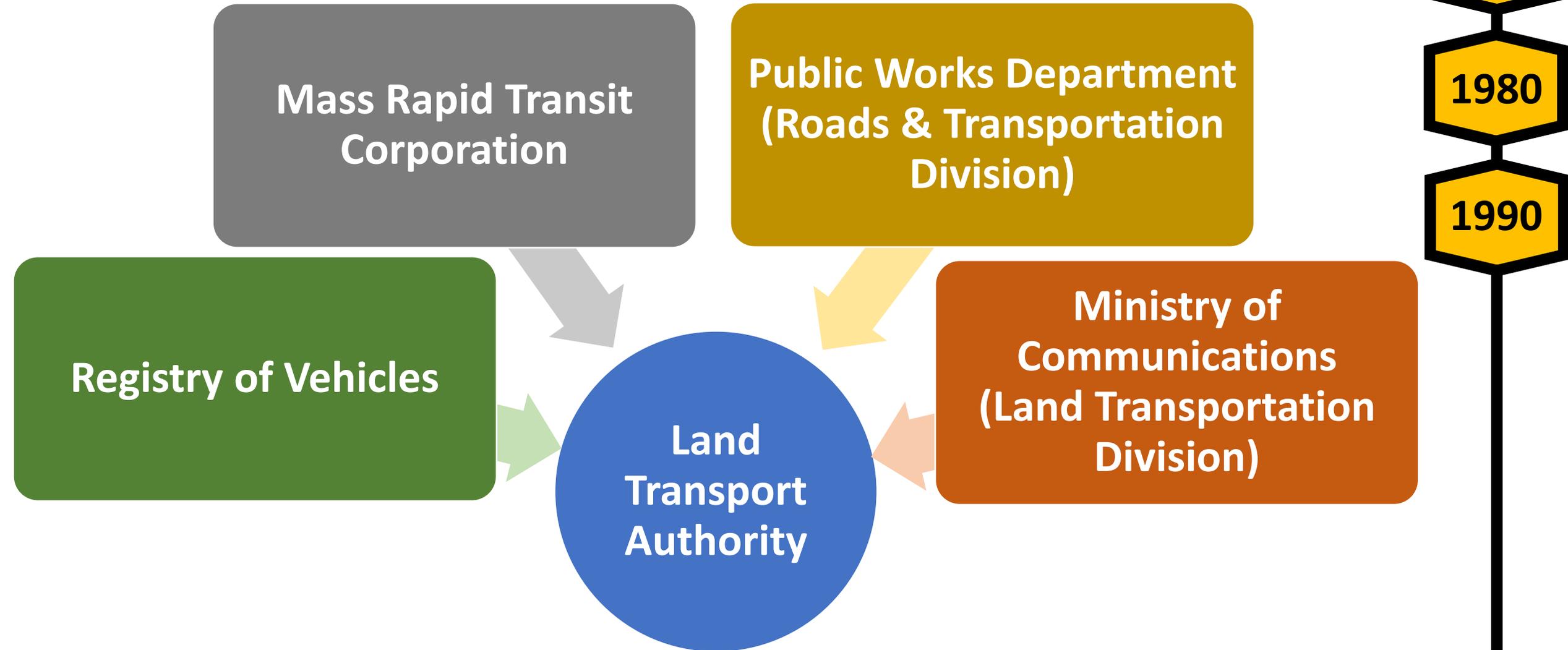
1970

1980

1990

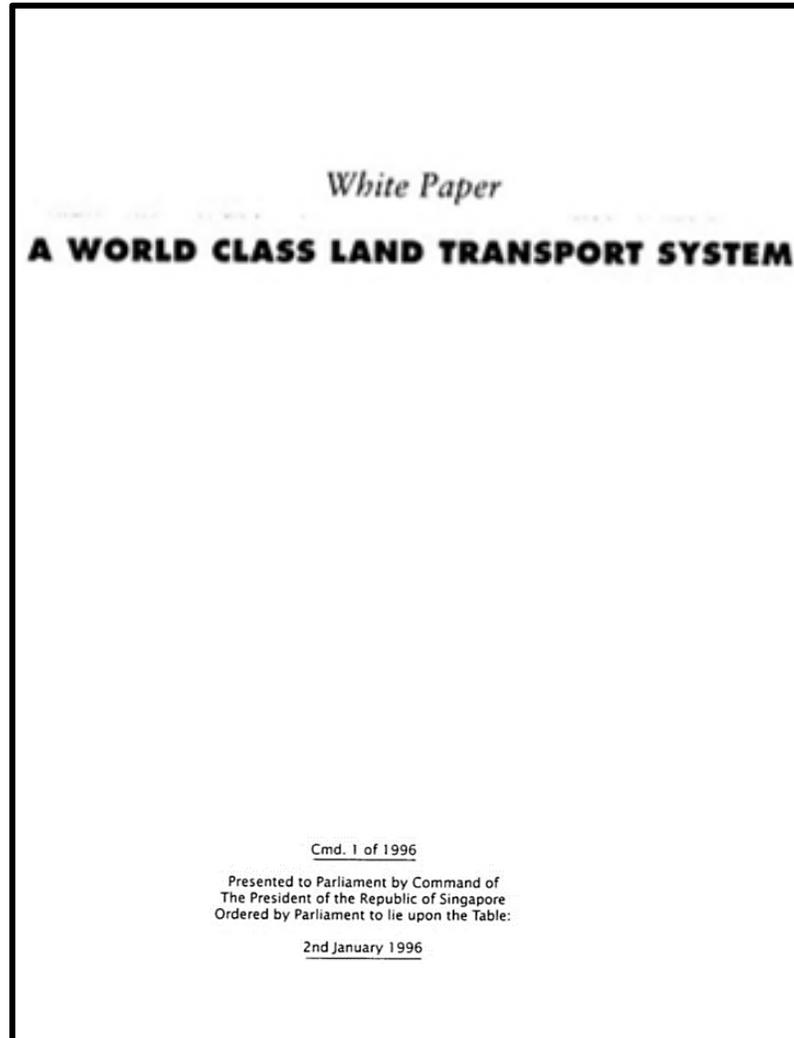
# Establishment of Land Transport Authority

- Four public entities merged to form the Land Transport Authority.



# White Paper 1996

- LTA published a White Paper in 1996, detailing the vision to achieve a World Class Land Transport System.



**Financing  
Framework**



**Initiatives to Improve  
Public Transport  
System**

1970

1980

1990

# White Paper (Financing Framework)

- The White Paper set out three key principles for financing framework.

**1** Fares have to be realistic and regularly revised to account for justifiable cost increases.

**2** The services must at least recover operating cost.

**3** Provision for depreciation and asset replacement must be adequate.

1970

1980

1990

# White Paper (Financing Framework)

1

Fares have to be realistic and regularly revised to account for justifiable cost increases.



Better Rides • Affordable Fares • Sustainable Public Transport



1970

1980

1990

**Independent body to regulate public transport fares**

**Comprises members from a wide cross-section of society**

# White Paper (Financing Framework)

1

Fares have to be realistic and regularly revised to account for justifiable cost increases.

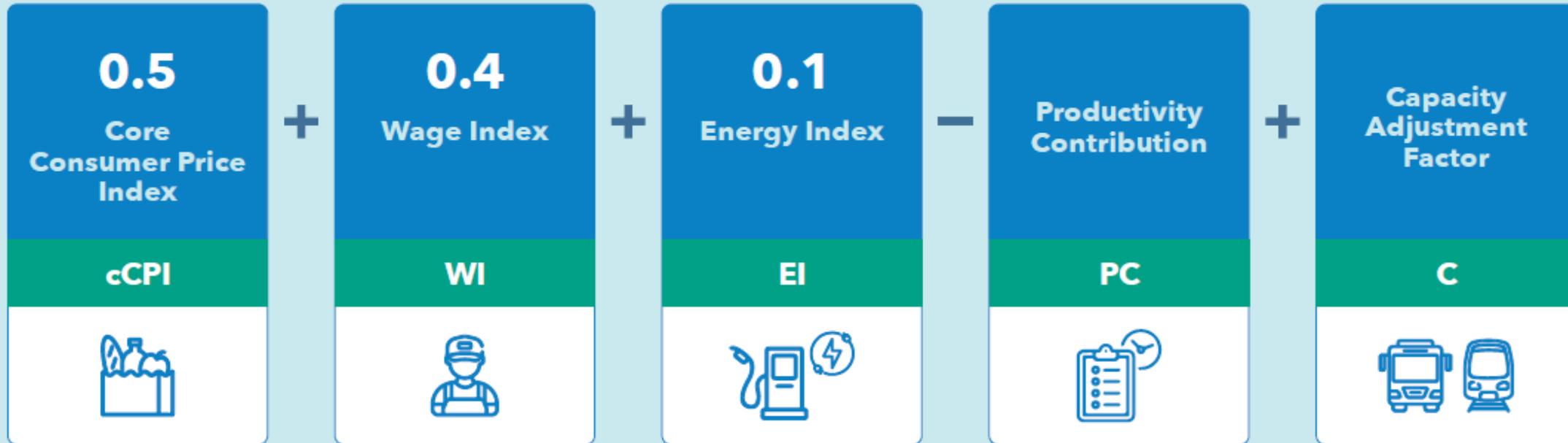


Image courtesy of Public Transport Council

**Fare Adjustment Formula (2023 – 2027)**

1970

1980

1990

# White Paper (Financing Framework)

2

The services must at least recover operating cost.

**Viability of New Rail Lines**

**Economic Viability**

**Cost**

**Benefit**

**Financial Viability**

**Cost**

**Revenue**

1970

1980

1990

# White Paper (Financing Framework)

3

Provision for depreciation and asset replacement must be adequate.

Historical Cost  
of First Set of  
Operating  
Asset



Increase in Cost  
due to Inflation



Cost of  
Second Set of  
Operating  
Assets

*Fare Revenue*

*Co-financing from  
Government*

1970

1980

1990

# White Paper (Improving Public Transport)

- The White Paper introduced two key strategies to improve the public transport system.

## Key Strategies

**Integrated Land Use &  
Transport Planning**

**Expanding Rail  
Network (Backbone  
of Transport System)**

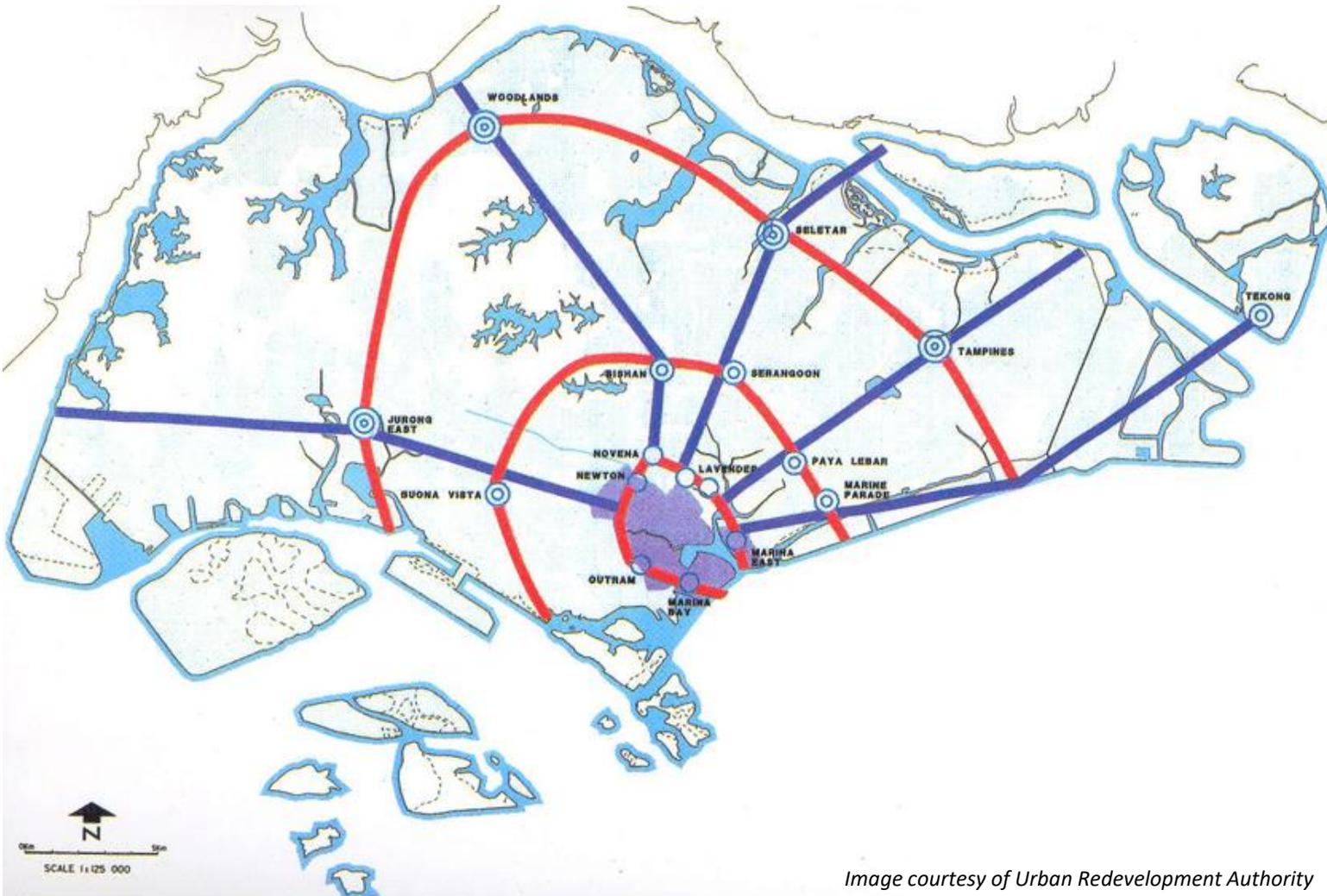
1970

1980

1990

# Integrated Land Use & Transport Planning

- Concept Plan 1991 adopted a “Constellation Concept” to decentralise commercial and other activities, while supported by the rail network.



## Legend

-  Mass Transit Corridor - Radial
-  Mass Transit Corridor - Circumferential
-  Regional Centre
-  Sub-regional Centre

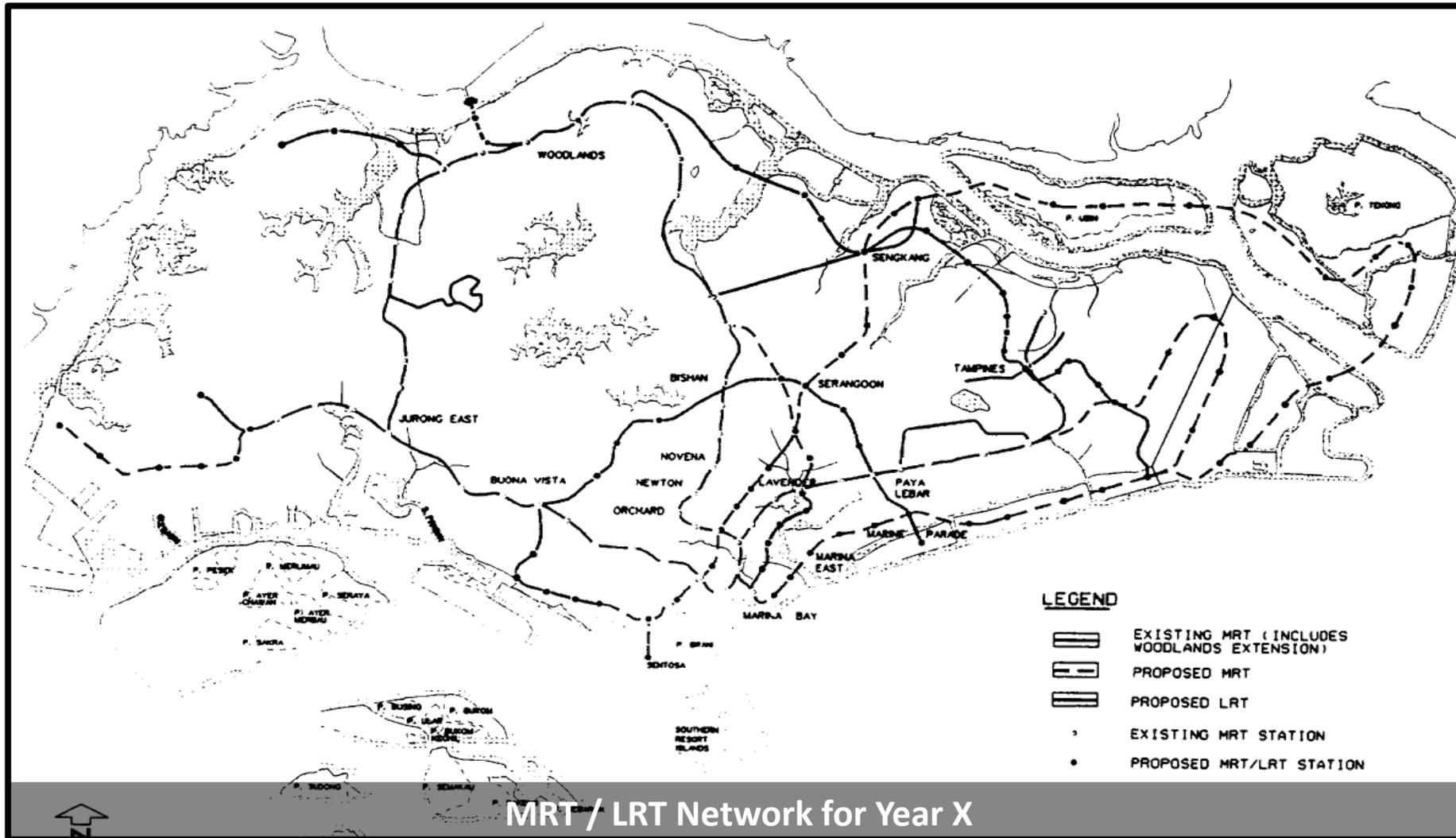
1970

1980

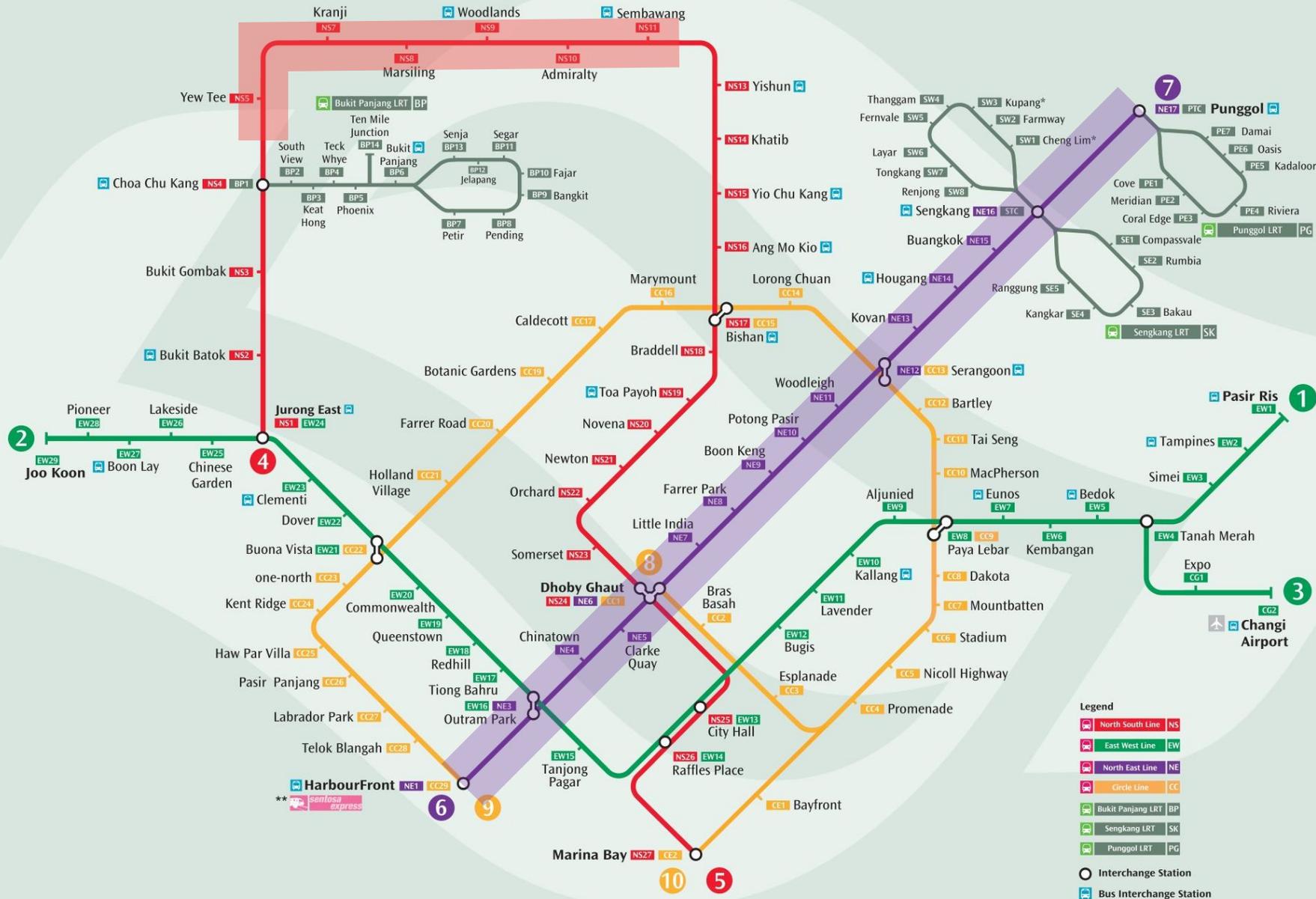
1990

# Expanding Rail Network

- The White Paper planned for a rail network of at least 160km in the long term, to serve as the backbone of our public transport network.



# Expanding Rail Network



Woodlands Extension was built to serve the regional centre.

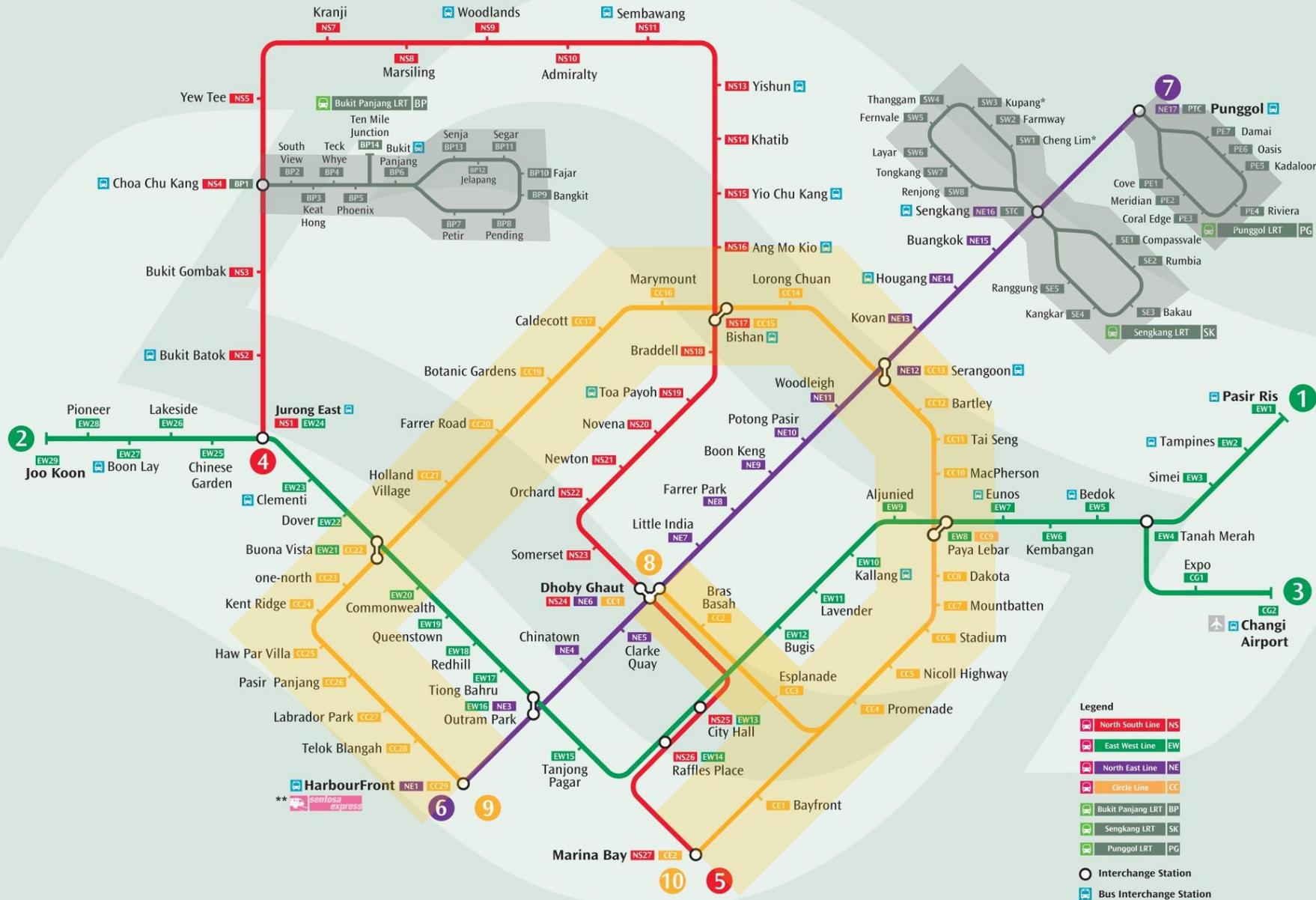
North East Line was built to serve the regional centre.

1970

1980

1990

# Expanding Rail Network



Circle Line was built to serve the sub-regional centres.

Light Rail Transit (LRT) was built to serve corridors with lighter traffic.

1970

1980

1990

# Fully Automated Driverless System

- North East Line is the world's first fully automated underground driverless heavy rail rapid transit line.

## Benefits

Address challenge in recruiting Passenger Train Operators

Provide flexibility to introduce or withdraw trains

Minimise error in human intervention



Inspection of North East Line trains



North East Line Train

1970

1980

1990

# Entry of Second Multi-modal Operator

- Competitive tendering was adopted for North East Line and Sengkang and Punggol LRTs, leading to entry of second multi-modal operator.



North-South  
Line

East-West  
Line

Circle  
Line

Thomson-East  
Coast Line

Bukit Panjang  
LRT



North East  
Line

Downtown  
Line

Sengkang  
LRT

Punggol  
LRT

1970

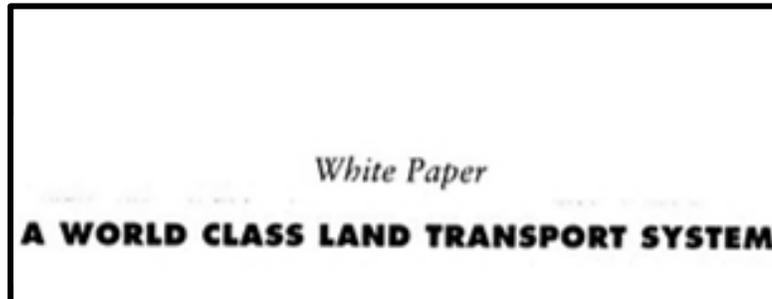
1980

1990

*Info accurate as of 2023*

# Land Transport Master Plan 2008

- Due to new challenges, LTA released Land Transport Master Plan 2008, focusing on a “People-Centred Land Transport System”.



Increasing Travel Demand

Declining Public Transport Mode Share

Cmd. 1 of 1996  
Presented to Parliament by Command of  
The President of the Republic of Singapore  
Ordered by Parliament to lie upon the Table:  
2nd January 1996



1970

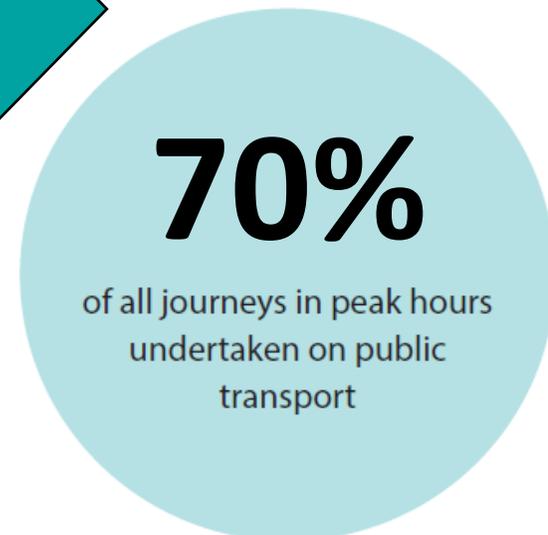
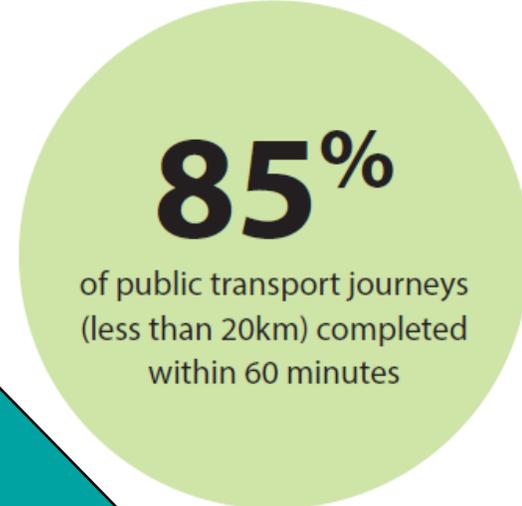
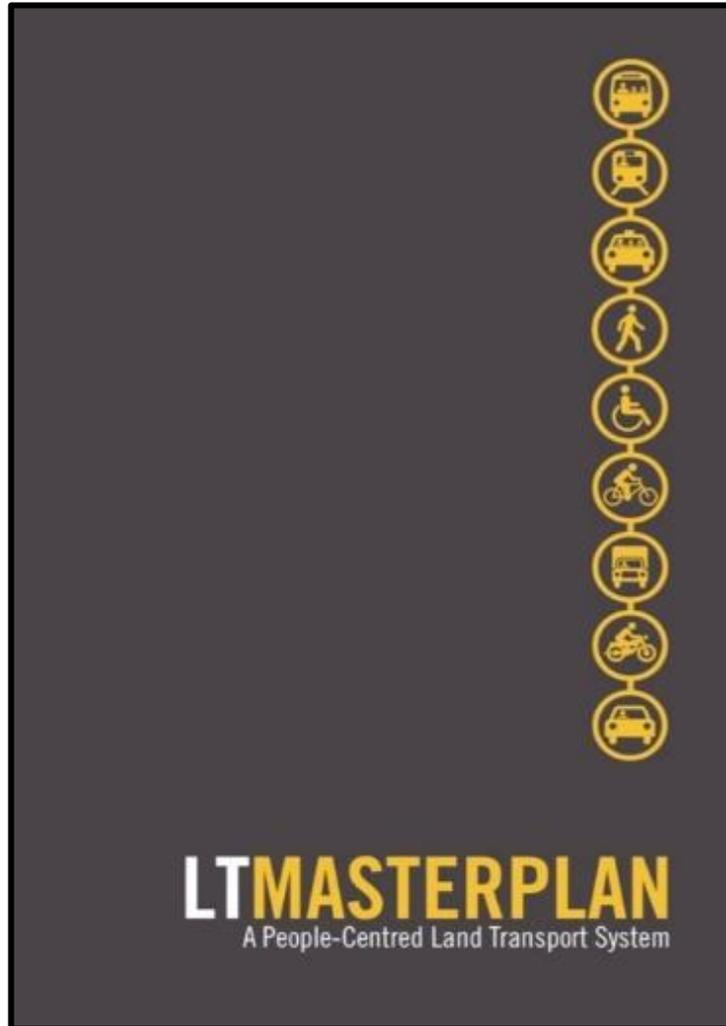
1980

1990

2000

# Land Transport Master Plan 2008

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# Land Transport Master Plan 2008

## Key Strategies

- a** Double Rail Network by 2020
- b** Enhance Rail Capacity by Increasing Train Frequency
- c** New Rail Financing Framework
- d** Central Bus Network Planner

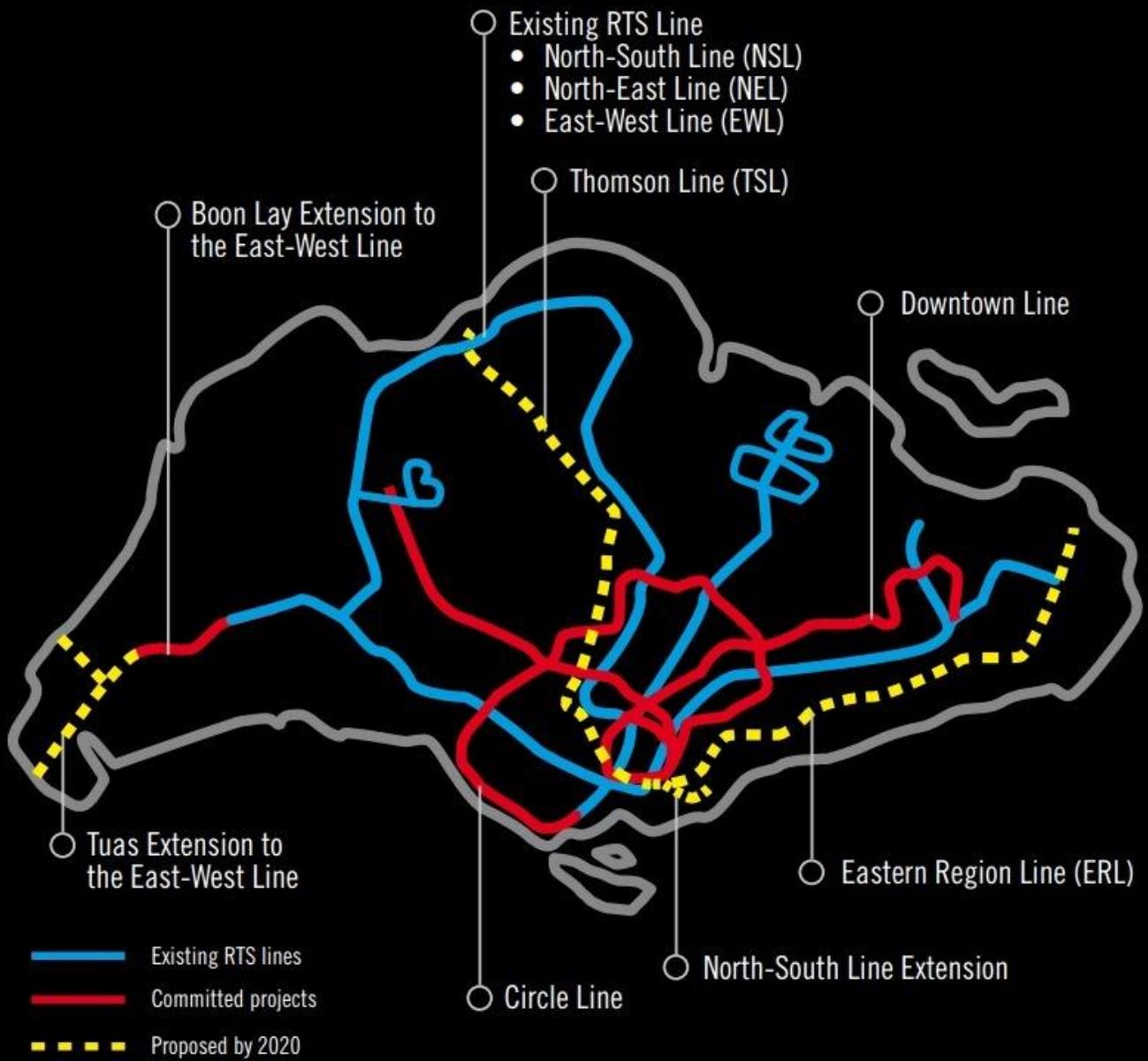
1970

1980

1990

2000

# Double Rail Network by 2020



1970

1980

1990

2000

# Increasing Train Frequency

1

- **Revise Operating Performance Standards to prescribe minimum train headways**

2

- **Invest in Additional Trains**

3

- **Modification to Signalling System**

1970

1980

1990

2000

# New Rail Financing Framework

- The Downtown Line is the first MRT line to come under the New Rail Financing Framework.

## Old Model

Operator owns, maintains & makes decisions on building-up, replacement & upgrading

No Licence Charge

30 to 40 years

Operating Asset

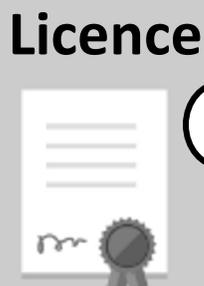


1

Asset



2



Licence Period



3



Licence Charge



## New Model

LTA owns and makes decisions on building-up, replacement & upgrading while Operator remains responsible for maintenance

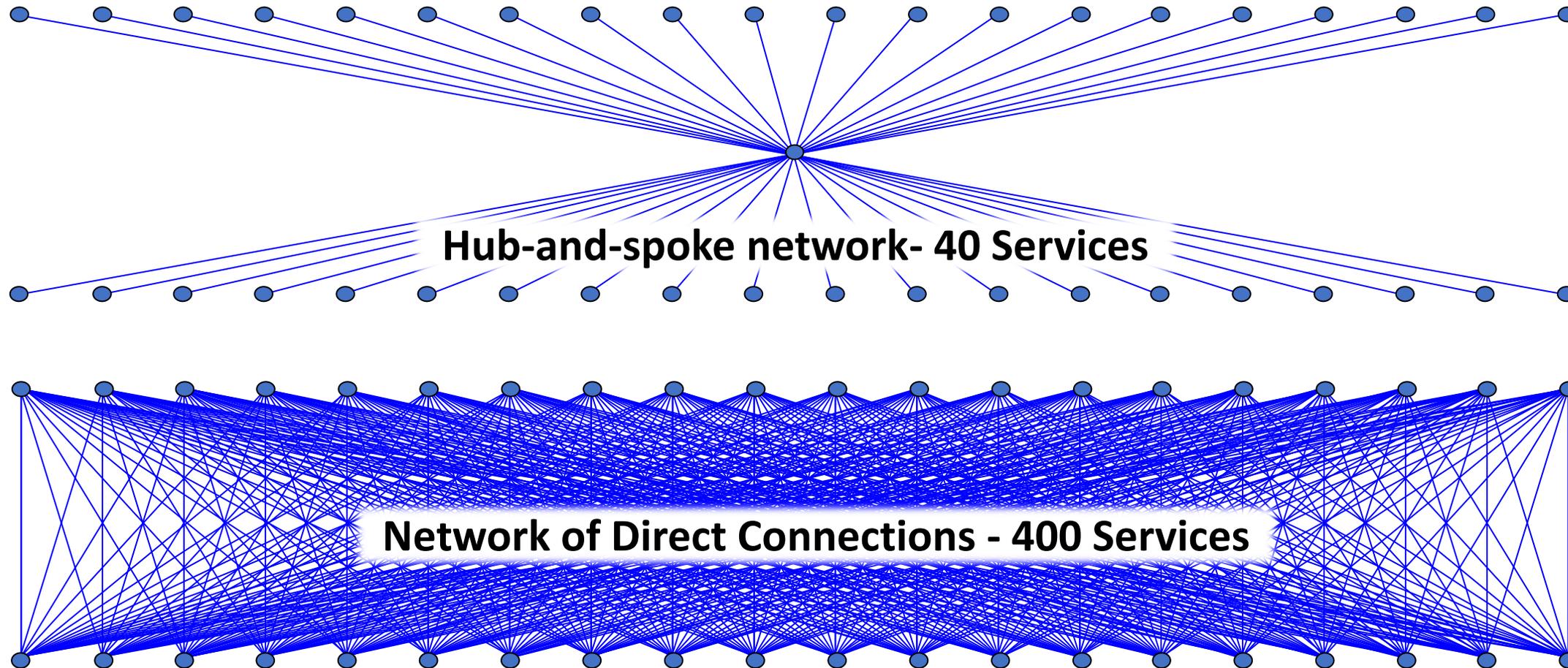
Operator pays an annual Licence Charge into the Railway Sinking Fund, which will fund replacement & repair of operating assets

15 years  
(possible 5-years extension)



# Central Bus Network Planner

- LTA took on the role of central bus network planner to enhance the hub-and-spoke model, reinforcing MRT as backbone of our network.



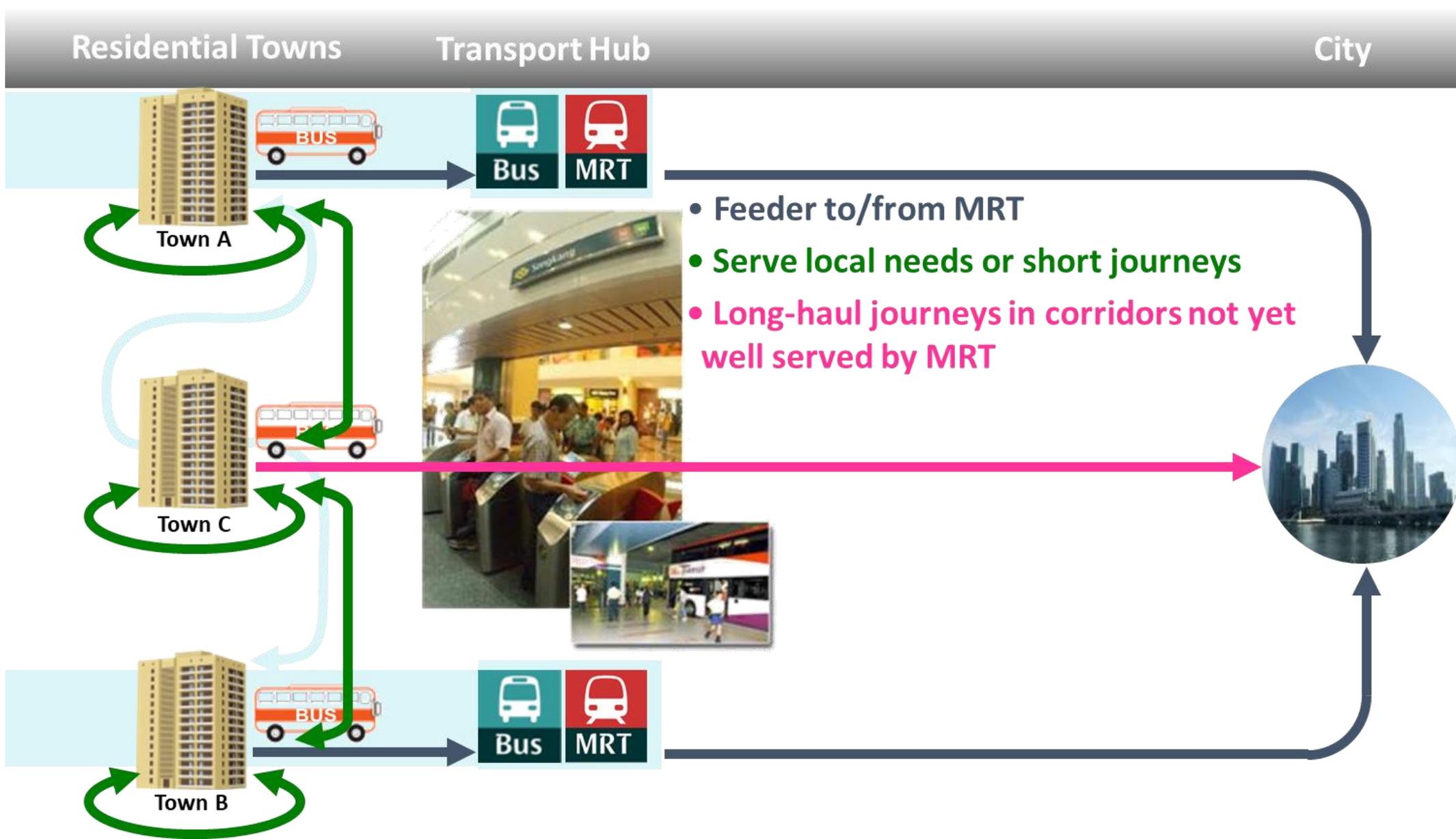
1970

1980

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2000

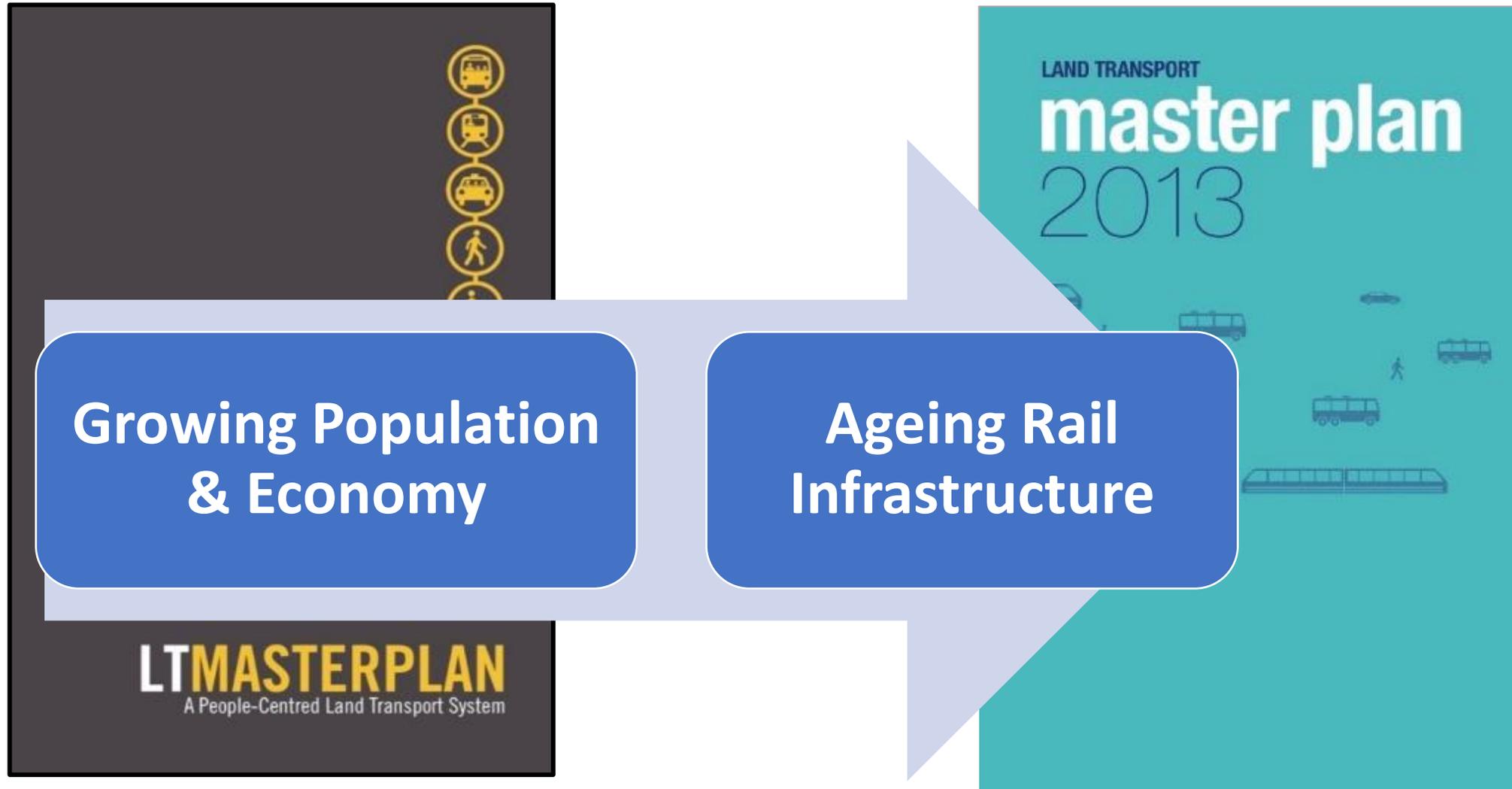
# Central Bus Network Planner



1970  
1980  
1990  
2000

# Land Transport Master Plan 2013

- As new considerations emerged, LTA released Land Transport Master Plan 2013, focusing on “Enhancing Your Travel Experience”.



1970

1980

1990

2000

2010

# Land Transport Master Plan 2013

## Key Targets for 2030

**8 in 10**

households living within  
a 10-minute walk from a  
train station

**85%**

of public transport journeys  
(less than 20km) completed  
within 60 minutes

**75%**

of all journeys in peak hours  
undertaken on public  
transport

## Key Strategies

**a**

**Expanding Rail  
Network**

**b**

**Enhancing Rail  
Reliability**

1970

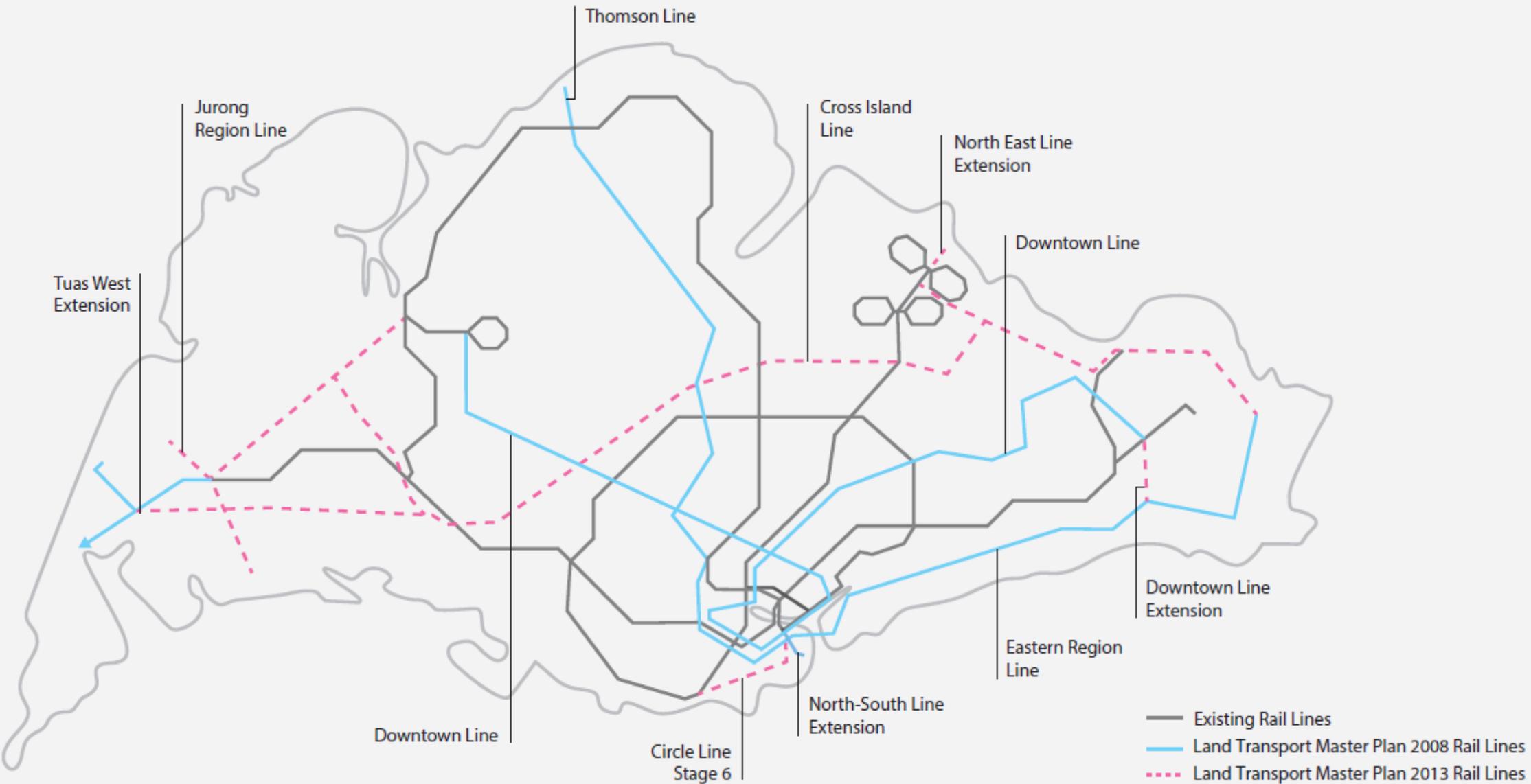
1980

1990

2000

2010

# Expanding Rail Network



1970

1980

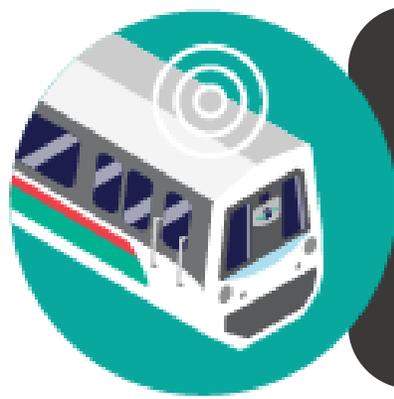
1990

2000

2010

# Enhancing Rail Reliability

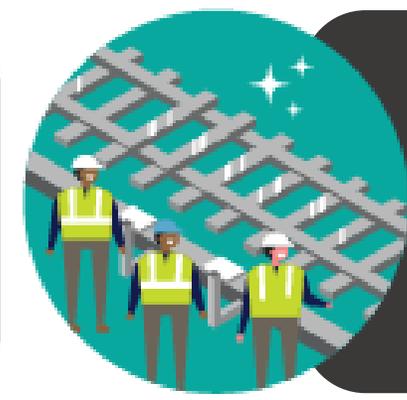
- We embarked on a major upgrading programme for North-South and East-West Lines from 2012 to 2023.



**New Signalling System**



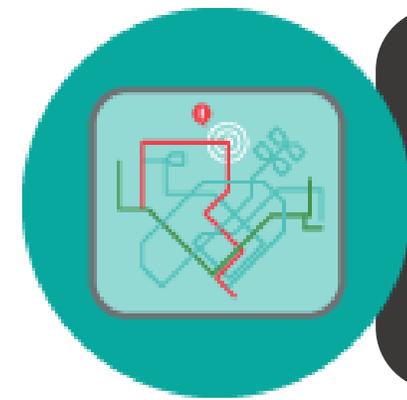
**Replacement of Sleepers**



**New Third Rail**



**New Power Supply System**



**New Track Circuit System**



**New Trains**



# Enhancing Rail Reliability

- The MRT network maintained over 1,000,000 MKBF since 2019.
- The Rail Reliability Incentive (RRI) aims to incentivise Operators to improve reliability of train services.



## 1,000,000 Mean Kilometres Before Failure (MKBF)

MKBF measures how far a train travels before a delay of over 5 minutes.

MKBF is an internationally recognised indicator for rail reliability and adopted by the Community of Metros (COMET).



# Land Transport Master Plan 2040

- To prepare Singapore's rail network for the future, LTA released Land Transport Master Plan 2040, with planning horizon up to 2040.



Commuters' Aspirations

Sustainability

Digitalization & Automation



1970

1980

1990

2000

2010

2020

# Land Transport Master Plan 2040

- We envision a Singapore made up of 20-minute towns within a 45-minute city which is aligned with commuters' aspirations.
- Rail network expansion plans are underway to achieve marked reduction in travel times.



1970

1980

1990

2000

2010

2020

# Current Lines



1970

1980

1990

2000

2010

2020

# Ongoing Lines

Jurong Region Line

North East Line Extension

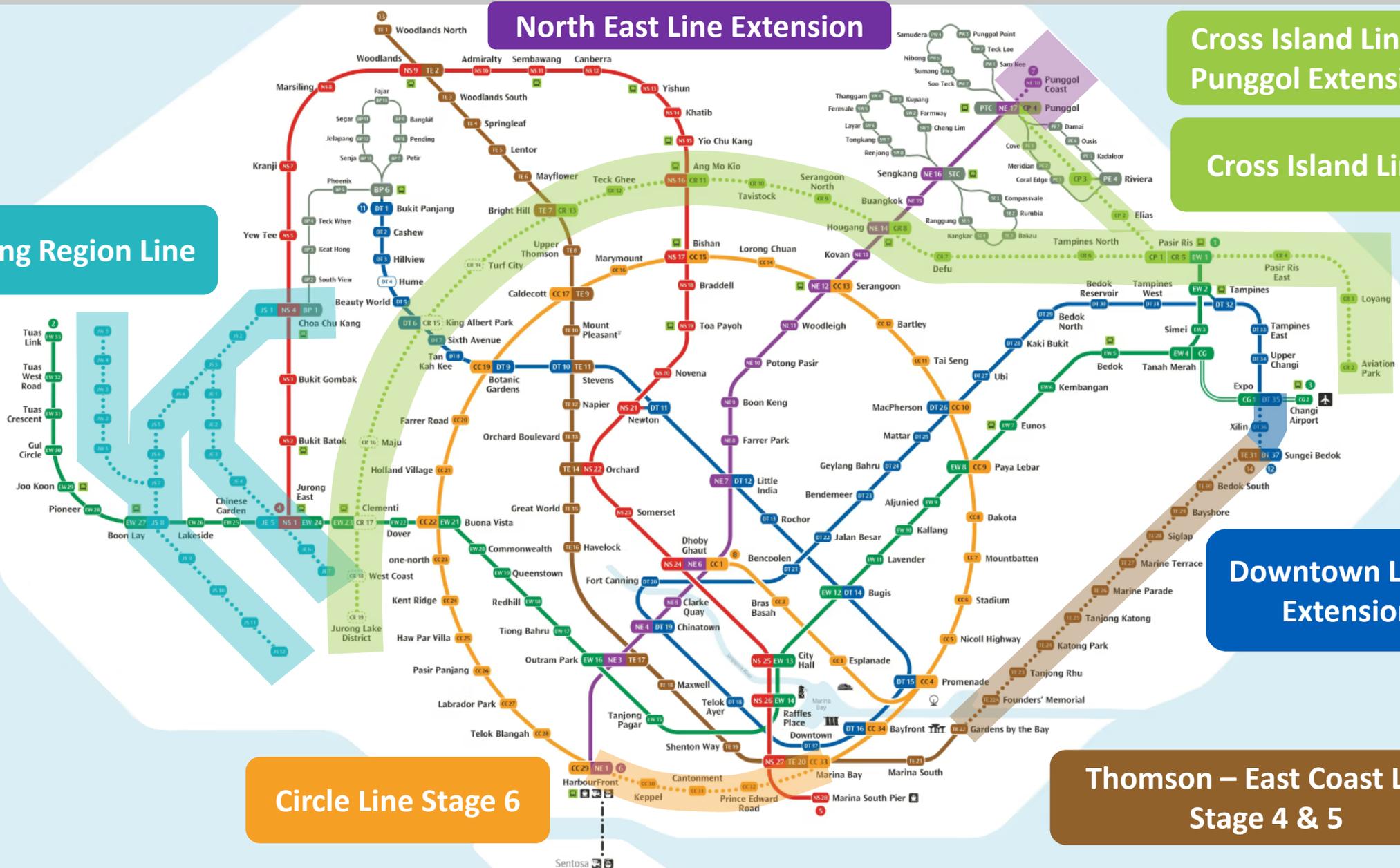
Cross Island Line – Punggol Extension

Cross Island Line

Downtown Line 3 Extension

Circle Line Stage 6

Thomson – East Coast Line Stage 4 & 5



1970

1980

1990

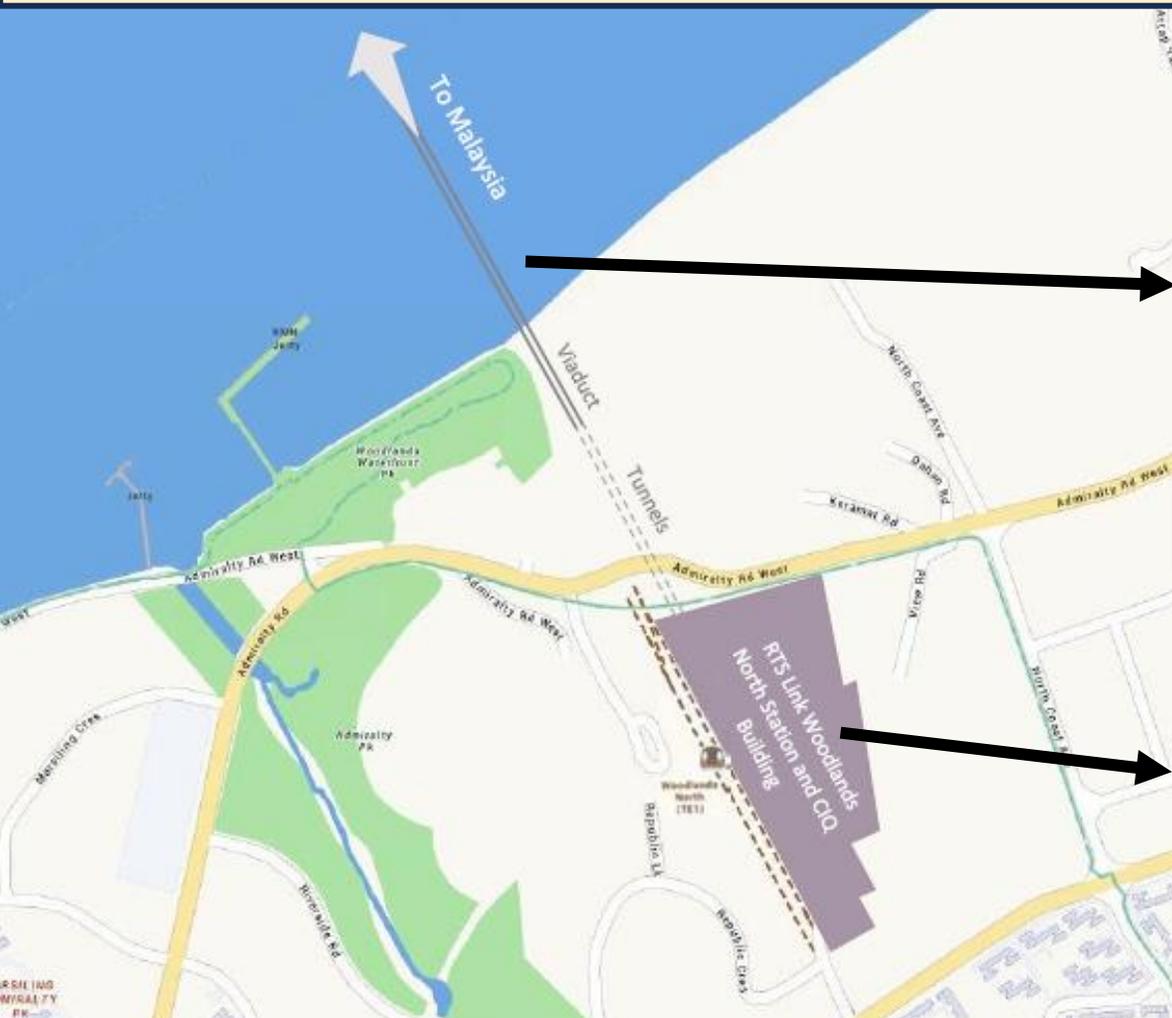
2000

2010

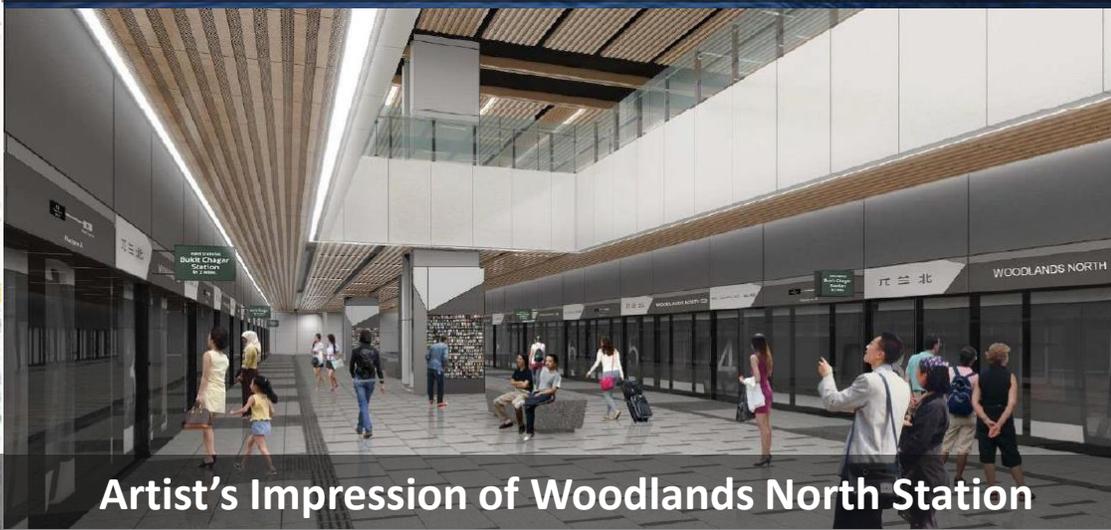
2020

# Ongoing Lines

## Johor Bahru – Singapore Rapid Transit System Link



Artist's Impression of RTS Link Viaduct



Artist's Impression of Woodlands North Station

Location of RTS Link Woodlands North Station

1970

1980

1990

2000

2010

2020

# Future Lines

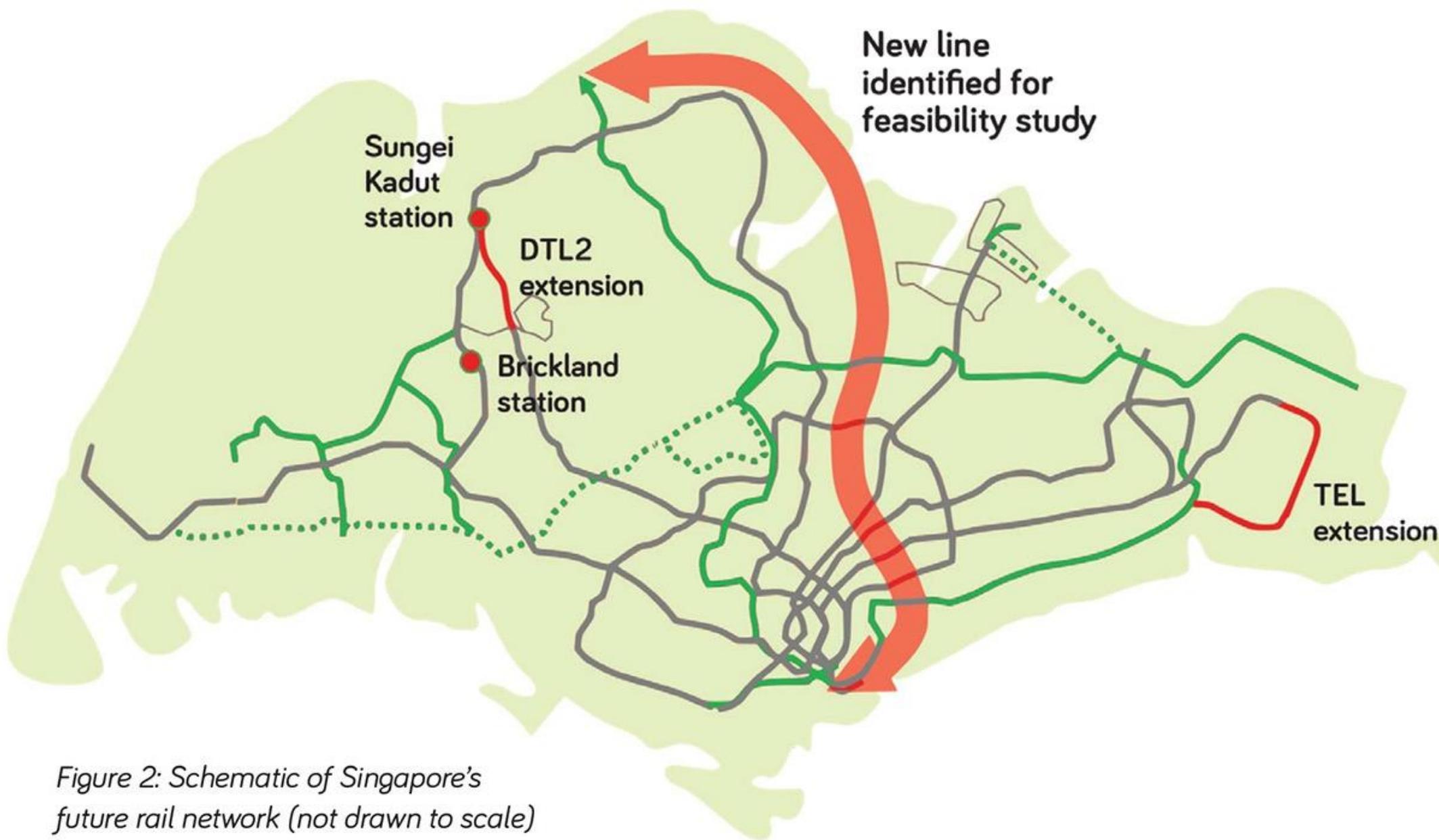


Figure 2: Schematic of Singapore's future rail network (not drawn to scale)

# Sustainability

- Climate change poses key threats to land transport system.



**Rising Sea Levels**



**Extreme Weather**

1970

1980

1990

2000

2010

2020

# Green Strategies

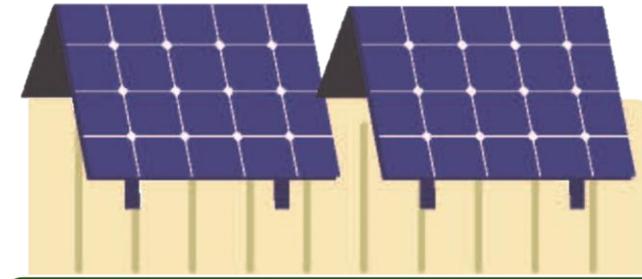
- Developed green strategies to promote sustainability efforts



**Green Commutes**



**Green Opportunities**



**Green Operations**



**Green Vehicles**



**Green Infrastructure**



**Green Communities**

1970

1980

1990

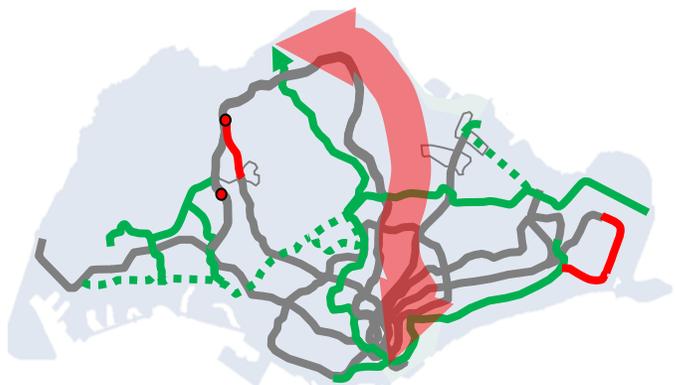
2000

2010

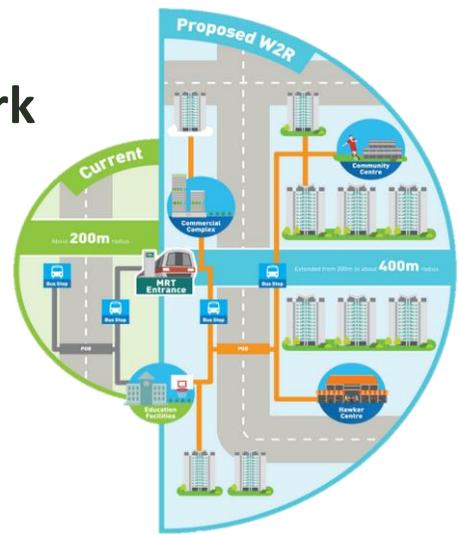
2020

# 1 Green Commutes

- Encouraging the switch to walking, cycling and taking public transport



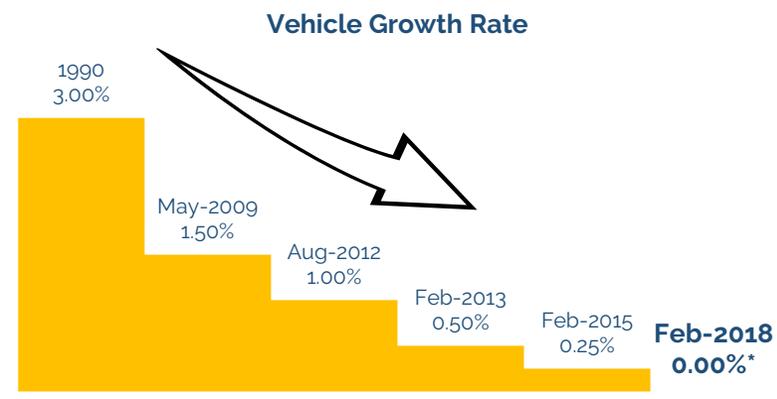
Expansion of rail network to 360km by 2030s



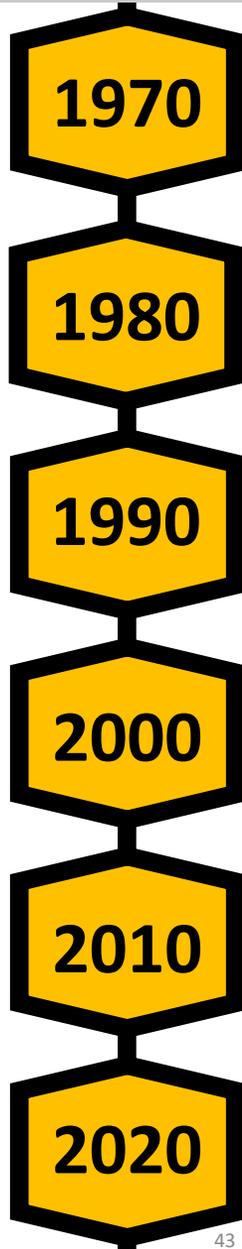
Expansion of sheltered walkway network by 150km by 2040



Expansion of cycling network to 1,300km by 2030s



Deprioritizing Car Ownership



# 2 Green Opportunities



Image courtesy of Delta Capita

**Green Financing**  
*Funding for green projects*



**Open Innovation**  
*Trial new green technologies*

- 1970
- 1980
- 1990
- 2000
- 2010
- 2020

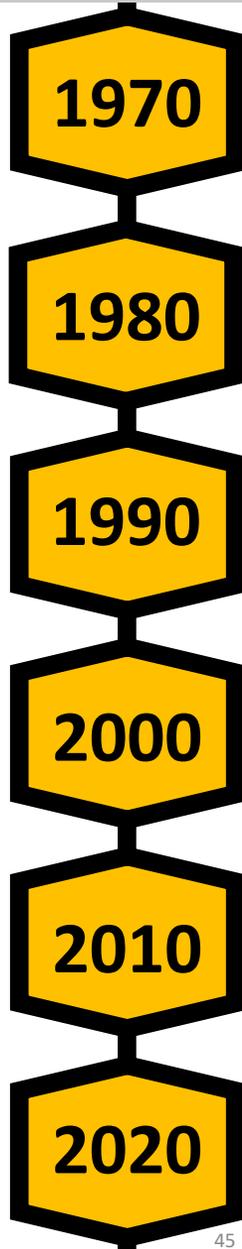
# 3 Green Operations



Renewable Energy  
*Increase deployment of  
solar energy*



Optimise Resource Usage  
*Improve energy usage in  
rail operations*



# Digitalization & Automation

- Digitalization and automation are no longer a good-to-have.
- They are a must-have.



1/4

of Singapore's population will  
be >65 years old by 2030



Every 12 hours

Knowledge is doubled (compared  
to every 13 months in 1982)

1970

1980

1990

2000

2010

2020

# Digitalization & Automation

## Our Railway Digitalization & Automation Journey

First MRT line  
start operations  
(Grade of  
Automation,  
GOA 2)

Bought back  
rail assets from  
Operators.  
O&M data start  
to come in

Study into  
Depot  
Automation  
and Common  
Data Platform

**1987**



**2003**



First fully  
automated  
MRT line, NEL  
(GOA 4)

**2016**



**2021**



Study into  
Maintenance &  
Engineering Centre  
(MEC)

**2023**



Formation of  
Rail  
Digitalization  
Division

**2024**



1970

1980

1990

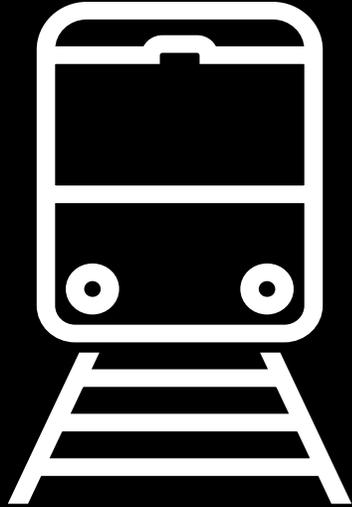
2000

2010

2020

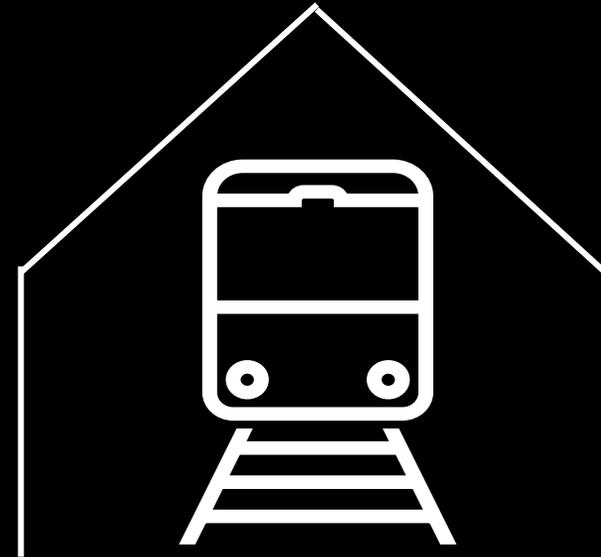
# Digitalization & Automation

A multi-team and multi-disciplinary effort...



## Digi Train

Standardizing Condition-  
monitoring data to be collected  
for all train fleets



## Digi Depot

Leveraging on  
automation to optimize  
workflows

1970

1980

1990

2000

2010

2020

# THANK YOU

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